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TECHNICAL REPORT

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**EXPERIMENTAL EVALUATION OF THE
MODULAR FAST FOOD SERVICE FACILITY AT
TRAVIS AFB**

by

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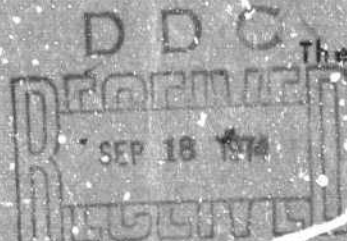
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May 1974

UNITED STATES ARMY
NATICK LABORATORIES
Natick, Massachusetts 01760



Operations Research/Systems
Analysis Office

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Food Service System Design Menu Operation	Operations Evaluation Attendance Cost Productivity	Nutritional Evaluation Consumer Survey
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INTRODUCTION

During FY 1973-74, the Operations Research and Systems Analysis Office conducted an investigation of Air Force food service operations under Task 03, Project Number 1J662713AJ45, Analysis and Design of Military Feeding Systems, of the DOD Food Research, Development, Test and Engineering program. This effort was directed primarily towards defining, developing and evaluating modifications to the existing food service system at Travis AFB, California, with the objective of improving performance, effectiveness and identifying possible cost reductions. One of the more important innovations deriving from this project was a modular fast food service operation, which was established and evaluated during a food service system experiment at Travis AFB between 1 November 1973 and 31 January 1974. The purpose of this operation was to increase customer participation and satisfaction with the total food service system by providing improved services, i.e., a food outlet conveniently located to the customer, offering the types of foods which are highly popular with the age-group comprising the major segment of the consumer population, and which is available to the users at times of their own choosing rather than being required to eat on a rigid, and perhaps unrealistic schedule as required in the dining halls. This report contains a description of the operation and performance of the facility during the experiment.

OBJECTIVES

The modular fast food service facility was designed and operated to meet the following basic objectives, established on the basis of earlier consumer surveys and system studies:

1. To conveniently locate a food outlet close to a dormitory area for both RIK and BAS customers, which also would be readily accessible to customers arriving by car.
2. To offer popular, high preference foods, prepared to order for take-out service.
3. To serve approximately 500 short-order meals over an extended period each day.
4. To minimize the total food and labor costs required to operate the facility.
5. To provide for adequate nutritional levels consistent with accepted requirements.

FACILITY DESIGN

Several facility design options were considered with respect to these objectives, and it was determined that a modular fast food service unit would best satisfy these objectives

and generate maximum consumer appeal. It was located in the parking lot of one of the three enlisted dormitory areas, alongside the major thoroughfare at Travis AFB which permitted easy access by automobile.

The preliminary design, equipment selection, layout and specifications were completed at Natick Laboratories (see Figure 1), and a contract awarded for construction of the modular unit. It is an all steel, unibody structure completely equipped with all necessary food service equipment for a fast food operation. The outside dimensions are 10'4" x 24'4" (width x length), with a reverse board and batten exterior siding and a shingled Mansard roof line bordered by a single row of colored chaser lights. The interior consists of poured vinyl flooring, insulated white Marlite walls and ceiling (8' high), stainless steel counters, sinks, exhaust hoods and equipment cabinets, and high-output fluorescent lighting. An air-conditioning/heating unit is mounted through the ceiling. A fat-filtering system for the deep-fat fryers was subsequently added, and a prototype pizza oven was provided from a commercial source for the experiment.

Installation requirements include a 115-230 volt, 200 amp, single-phase electrical service, a 4" sewer waste line and a 1" cold water supply line. Natural gas service may be used, although propane tanks were installed at Travis because of the distance from the nearest gas lines. A sanitary sewer line is not required since latrine facilities are not provided, and grease-traps are self-contained in the facility. The base frame of the modular unit is fabricated of 8" steel beams, so that it can be mounted directly on a paved surface or blocks or timbers if leveling is necessary. The total weight, approximately 18,000 pounds, is sufficient to eliminate the necessity for anchoring to a fixed foundation.

The cost of the unit, "one-of-a-kind" built and equipped to our specifications, was \$35,875 including delivery and the required operational acceptance testing. It is expected that the cost of additional units will be somewhat less, unless extensive engineering changes and equipment modifications are desired. The costs of site preparation and installation vary depending on the relative location, capacity of existing utilities and the extent of work involved.

MENU

The principle criteria for menu planning were that it consist of the highest preference short order items (as identified by preliminary food preference surveys at Travis AFB), be compatible with proposed food preparation methods and equipment constraints, and provide for sufficient variety and nutritional adequacy within allowable costs. The menu design for the experiment is included as Table 1.

Feature items and sandwiches were prepared to order. Chicken was pre-cooked and frozen in bulk in the Inflight Kitchen, using a pressure fryer installed for that purpose.

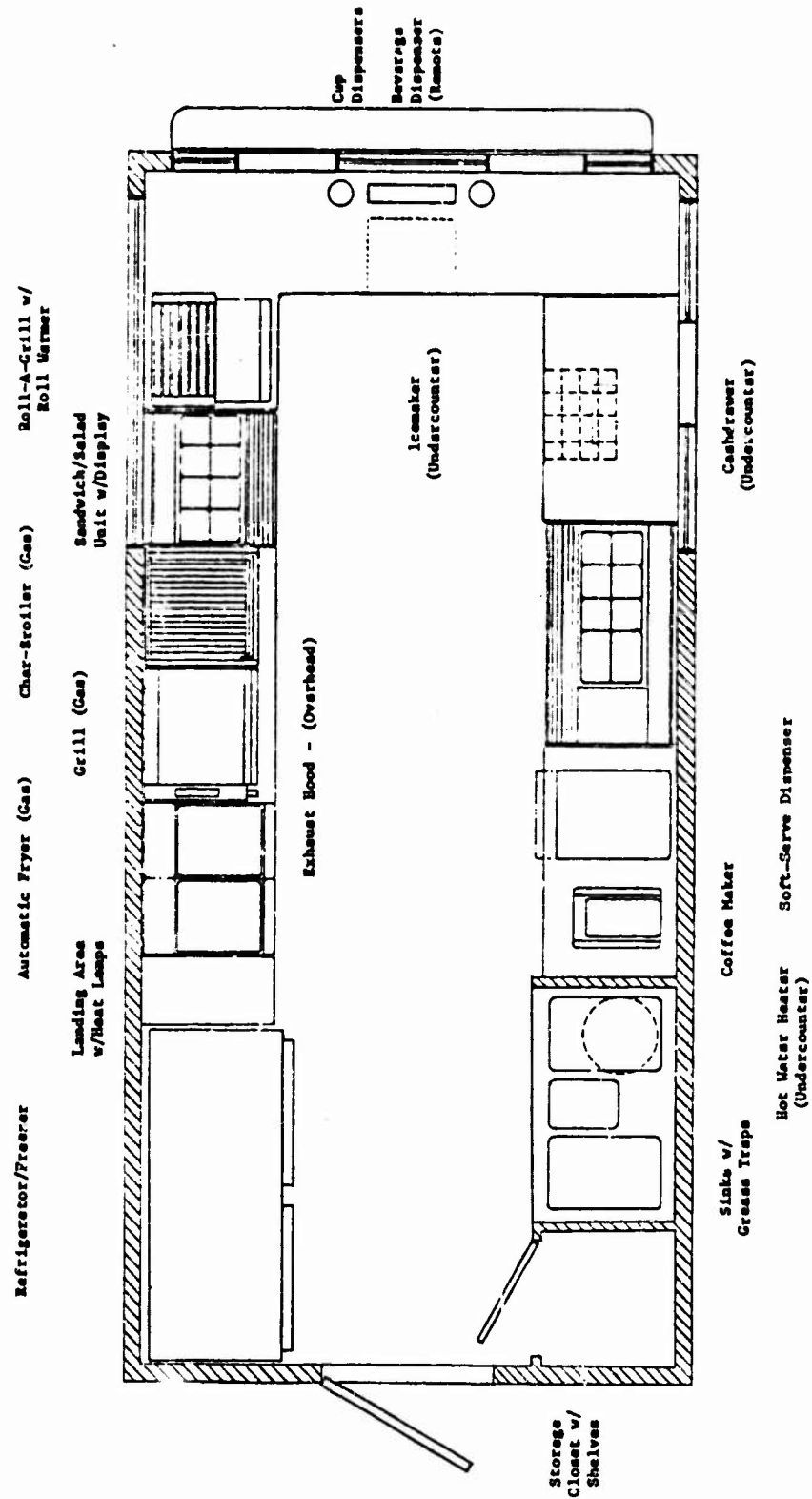


FIGURE 1. SKETCH OF MODULAR FAST FOOD SERVICE UNIT

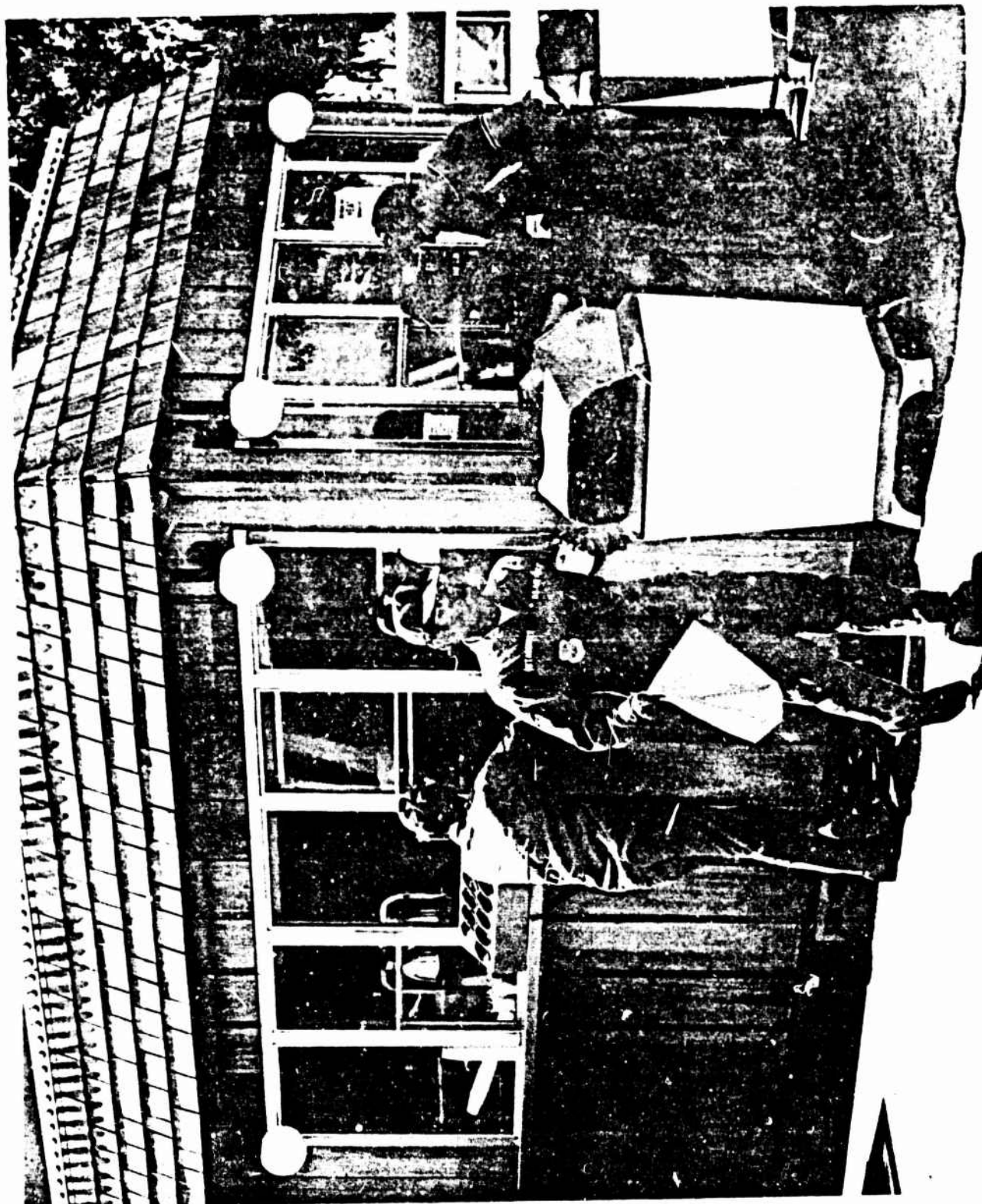


FIGURE 2. PHOTOGRAPH OF MODULAR FAST FOOD SERVICE UNIT

TABLE 1

FAST FOOD MENU

SALADS

MON	Cole Slaw	and	Canned Fruit
TUE	Lettuce & Cucumber	and	Jellied Fruit
WED	Cole Slaw	and	Canned Fruit
THU	Lettuce & Onion	and	Cottage Cheese & Fruit or Jello
FRI	Cole Slaw	and	Canned Fruit
SAT	Lettuce & Radishes	and	Cottage Cheese & Fruit or Jello
SUN	Lettuce & Tomato	and	Canned Fruit

FEATURE ITEMS

Fried Chicken or Fried Fish
French Fries
Hamburger w/Lettuce and Tomato
Cheeseburger w/Lettuce and Tomato
Grilled Ham and Cheese
Grilled Cheese
Grilled Ham
Frankfurter

COLD SANDWICHES

Bacon, Lettuce and Tomato
Turkey or Turkey Club
Ham or Ham Club

ADDITIONAL ITEMS

Rolls with Butter or Margarine Pats
Potato Chips
Dressing Packets (French, Thousand
Island, Creamy Italian, & Plain)
Condiment Packets

BEVERAGES

Milk
Coffee
Carbonated (Cola, Orange,
Root Beer, & Lemon-Lime)

DESSERTS

Pie (Apple, Cherry, Berry or Chocolate)
Cake or Cookies
Soft-Serve Ice Cream or Milkshake
Fresh Fruit

Most sandwich ingredients, french fries, milk, pastries, potato chips, butter and margarine and other such items were issued directly from the Inflight Kitchen. Some sandwich items, e.g., roast beef, were pre-cooked and sliced in the Inflight Kitchen. Salad dressings, tartar sauce, ketchup, relish, etc. were obtained in individual portion packages from commercial sources. Salads were freshly prepared and packaged in clear plastic containers in the Inflight Kitchen. Coffee, carbonated beverages and soft-serve milkshakes were made and dispensed in the facility.

During the experiment, there were periods when commercial brands of frozen chicken were used, with no apparent loss in customer acceptance. Different fast food items — such as individual pizzas, frozen burritos and frozen meat and fruit turnovers — were offered on a trial basis with varying degrees of success. The planned variety of salads were often not available, and lettuce and tomato salad or cole slaw were substituted. The occasional use of fresh fruit demonstrated that it should be included on the menu.

Every day, a feature meal was available, which usually consisted of fried chicken or fish, french fries, salad, and rolls and butter, packaged in a carry-out box. The customer could also select beverages and dessert to complete the meal. This proved to be the most popular feature of the operation to the customers. All other menu items were ordered a la carte, and served on a carry-out tray designed for that purpose. Each person was permitted two sandwiches, french fries, salad, two beverages, a dessert and additional items as desired.

OPERATION

The operating hours were from 1100–2130 hours daily, except closing between 1330-1500 to allow for clean-up, resupply, rest-breaks and a meal period for the operating personnel.

Total staffing consisted of a facility supervisor, cook, four food service workers and an airman assigned to perform the supply function. Generally, three persons operated in the facility during the noon meal period, until 1330, because of the large customer loads. At other times, only two persons were required to provide adequate service. The cook was assigned full-time to the Inflight Kitchen, as were all other scheduled personnel when not operating in the modular facility.

Control procedures were essentially identical to those used in the dining halls. Rations-in-kind (RIK) customers were provided meals at no cost after signing the headcount register, and personnel receiving a basic allowance for subsistence (BAS) were required to pay standard meal charges. Meals were not sold or served to any person not properly authorized to utilize appropriated fund dining facilities, or civilians and dependents.

Overall responsibility for management and supervision was assigned to the Inflight Kitchen supervisor. Standard accounting procedures for the Inflight Kitchen were adapted to this operation, utilizing existing forms for issue and receipt of subsistence and supplies, for headcount and for reporting. In addition, informal records were maintained by the Food Service Staff Office on the number of meals served, net cost of issues and income earned so that performance could be continually monitored and evaluated.

PERFORMANCE EVALUATION

A. Headcount. Total headcounts in the modular facility for each month of the experiment are summarized below. This headcount represent 11.4% of all meals served

Month	RIK	BAS	Total
25-30 November 73	1850	145	1995
1-31 December 73	9264	757	10021
1-31 January 74	11844	648	12492
Total	22958	1550	24508

in the dining facilities subsequent to the date this facility opened. For a total of 66 days of operation (the facility was closed on Christmas and New Year's days), an average of 372 meals per day were served, of which nearly 94% were to RIK personnel. At the conclusion of the experiment, 500 meals per day were being served, which has since increased to approximately 600 meals per day.

A detailed analysis of headcount data, from a sample of 16150 attendance records acquired in the modular facility over 54 days of operation, reveals a total 2136 distinct individuals utilized the facility during this period. Of this total, 430 airmen were identified as "new customers", i.e., for which there is no record of attendance at any dining facility during the almost five weeks of the experiment prior to start-up of this operation. The new customers each attended an average of approximately 0.8 meals per week in the modular facility, but perhaps more importantly, also began attending the other dining facilities at an average rate of 2.6 meals per week. The remaining 1706 customers had records of prior attendance; at an average of 5.9 meals/person per week in the other facilities during the early part of the experiment. After the modular fast food service became available, the totals for this latter group increased to an average of 6.7 meals per week, of which only one meal per week was in the modular facility. In summation, the modular facility not only attracted new customers and increased the utilization of regular customers, but these same groups also substantially increased their attendance in the other facilities as well.

		Modular Facility			Other Facilities		All Facilities	
		Total Meals	Meals/Person per week		Total Meals	Meals/Person per week	Total Meals	Meals/Person per week
New	BAS	150	309	0.3	721	0.6	1030	0.9
Customers	RIK	280	2174	1.0	7970	3.7	10144	4.7
	Total	430	2483	0.8	8691	2.6	11174	3.4
Regular	BAS	344	880	0.3	4806	1.8	5686	2.1
Customers	RIK	1362	12787	1.2	69745	6.7	82532	7.9
	Total	1706	13667	1.0	74551	5.7	88218	6.7
	Total	2136	16150	1.0	83242	5.0	99392	6.0

B. Food Costs. Monthly food costs are shown in the following table. The average cost per meal served was \$0.859 as compared to \$0.933 meal allowance, or about 8% reduction in raw food costs. The lower gain in January (i.e., earned income less net cost of issues) can be attributed primarily to the change in meal allowance factors, which became effective on 1 January 1974. The costs of disposable items for the meal service are not included in the above figures.

Month	Number of meals	Net Cost of Issues	Income	Gain
25-30 November 73	1995	1909.70	1987.02	77.32
1-31 December 73	10021	8786.03	9954.82	1168.79
1-31 January 74	12492	10351.12	10930.50	579.38
Totals	24508	21046.85	22872.34	1825.49

C. Labor Costs. Estimated labor costs are based on assigned staffing to both the modular facility and for supporting operations in the Inflight Kitchen. This is equivalent to a total of \$206.82 per day labor costs, or \$0.556 per meal. Productivity, or meals served per man-hour invested, is calculated as 9.3, as compared to 4.3* meals/man-hour for dining hall operations prior to the experiment.

Assigned Personnel	Hours per Week	Wage Rate* (per hour)	Cost per week
Modular Facility			
1. Supervisor (WS-1)	20	\$ 6.62	\$132.40
2. Food Service Workers (WG-2)	160	4.98	796.80

*See footnote, p.9.

Assigned Personnel (cont'd)	Hours per Week	Wage Rate* (per hour)	Cost per week
Inflight Kitchen			
1. Military Supervisor (E-6)	8	\$ 4.67	\$37.36
2. Supervisor (WS-1)	20	6.62	132.40
3. Cook (WG-5)	40	5.76	230.40
4. Military (E-3)	40	2.96	118.40
Total	288	—	\$1447.76

*Includes salaries and benefits

D. **Total Meal Costs.** Allowing for a factor of 10% of variable costs (i.e., raw food and labor costs), for utilities, laundry, trash collection, transportation, etc., the total meal costs during the experiment were:

Cost Component	Cost/M meal
Raw Food	\$0.859
Labor	0.556
Other	0.142
Total	\$ 1.557

These costs, were substantially less than the \$2.05* associated with dining hall operations.

NUTRITION EVALUATION

The food items selected at a meal were recorded for each of 267 randomly chosen persons at seven different periods during the time that the modular facility was in operation. Nutritional values were calculated for each food item using the Armed Forces Recipe

*Based on estimated average manning levels and food costs (i.e., net cost of issues) for June-August 1973, where food costs have been increased by 2.1% to reflect higher BDFA values.

Service formulations and USDA Handbook No. 8 food composition data. The nutritional values were summed over all food items comprising an individual meal, and then averaged for all meals and compared to the daily dietary allowance. Since seconds, and multiple servings could not be accurately accounted for in the data collection process, these values should be considered as the minimum average values for meals served in this facility. However, these results suggest that the menu is nutritionally adequate by established standards. Vitamin A is slightly low, but can easily be increased by consistently offering fresh salads and use of lettuce and tomatoes on sandwiches. It should also be noted that total caloric intake is not excessive, and the proportion of fat content is quite satisfactory. The criticisms usually levelled at fast food operations relative to these factors, do not seem to apply in this instance.

Nutritional Components		DDA ¹	Average Meal Values	% of DDA
Calories		3400	1013.6	30
Protein	g	100	72.6	73
Fat ²	g	152	42.5	28
Calcium	mg	800	507.1	63
Iron	mg	14	6.9	49
Vitamin A	IU	5000	1055.4	21
Thiamine	mg	1.7	0.6	35
Riboflavin	mg	2.0	1.1	55
Niacin	mg	22	8.7	40
Ascorbic Acid	mg	60	36.1	60

1. Daily dietary allowances for male personnel as prescribed by AFR No. 160-95, Medical Services Nutritional Standards, 10 Aug 1972.

2. Should not exceed 40% of total caloric intake.

CONSUMER EVALUATION

Direct face-to-face interviews were conducted with a random sample of 108 customers over a fifteen day period in November-December, soliciting their opinions and comments relating to performance and acceptability of this operation.

Several different measures of food acceptance were obtained. Each food item selected and eaten just prior to the interview was rated by the individual on a scale from 1 (disliked it extremely) to 5 (neither liked it nor disliked it) to 9 (liked it extremely). These ratings were then tabulated and summarized by broad food categories:

Category	RIK	BAS
Feature items	7.5	7.2
Salads & dressings	7.3	7.4
Potatoes & starches	7.1	7.0
Breads	7.0	7.0
Beverages	8.0	8.3
Desserts	7.3	8.0

An overall evaluation of the meal, using the same scale, produced an average rating of 7.4 for the RIK group and 7.6 for the BAS group. Comparison with other meals eaten in the Air Force, yielded the following results:

Rating	RIK	BAS
Much worse	1%	0%
Little worse	18	0
About same	42	46
Little better	24	36
Much better	15	18

Taken in total, these data strongly suggest a high degree of satisfaction with the foods served.

The customers were also asked their opinions of the operation, what they liked or disliked about the facility, and whether they wanted any changes made.

Opinion	RIK	BAS
Like	97%	90%
Dislike	1	0
Indifferent	2	10

Among the more significant comments of those customers who liked the operation were:

Category	% of Comments*
Convenience of location	28.2
Quick service	12.0
General positive remark (e.g., it's cool, it's great, etc.)	7.0
Quality of food good	5.6

*from a total of 144 comments

Similarly, the more important remarks relating to desired changes included:

Category	% of Comments*
Add shelter	28.3
Extend operating hours	13.0
Increase portion sizes	13.0
Quicker service	10.9

*from a total of 46 comments

Since only one person stated a dislike for the facility, and three expressed indifference, their comments are too few to allow for valid conclusions.

It is obvious that the customers reacted very favorably towards the operation. The changes identified as desirable, perhaps, need some explanation. First, note that although the percentages of comments pertaining to changes appear to be high, the total number of such statements is relatively small compared to the positive comments. Considering the amount of rainfall and high winds prevalent during the time of the interviews, the requirement for some sort of screen or overhead cover to protect the waiting customer was apparent. Even with the long operating hours and the amount of food a customer is permitted to take, a few (six comments in each case) want even more. The last comment listed, quicker service, seems inconsistent with the result that quick service is one of the more frequent positive remarks by people who liked the operation, but more than three times as many people consider it a plus feature of the operation. Probably, those five comments suggesting improved speed of service are somewhat related to the reasons for wanting a shelter, to avoid waiting in inclement weather.

CONCLUSIONS AND RECOMMENDATIONS

Preliminary consumer studies at Travis AFB showed a high preference for fast foods, e.g., hamburgers and fried chicken, and that a take-out service similar to commercial operations was highly desirable and readily acceptable. Further, it was determined that such a service would likely produce significant increases in attendance and utilization, which has been conclusively demonstrated by results from the experiment.

Given all of the other apparent advantages cited in this report — low capital investment, reduced food costs, higher labor productivity, nutritional adequacy, the high degree of acceptance by the customer, overall increase in headcount, and the potential for reduction of total subsistence costs — it is strongly recommended that the Air Force and other military services seriously consider the possible application of this concept to their food service requirements at other installations.

It should be noted that Travis AFB is continuing to operate the modular facility pending final Air Force decisions on this recommendation. Since the end of the experiment, performance has continued to improve. From 1-31 May 1974:

- a. Average headcounts were 627 per day.
- b. Raw food costs were \$0.86 per meal, the same as the average food costs during the experiment.
- c. Total labor requirements are unchanged.

Thus, the total cost per meal is even further reduced to about \$1.31 per meal, which is more than 35% less than the total cost per meal in conventional dining hall operations.

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RDT&E Advisor, Food Service Facility and Equipment Planning Board, Food Engineering Laboratory	1